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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/727,451	12/03/2003	Peter J. Hopper	100-18010 (P05268-D01)	7097
33402	7590	02/04/2005	EXAMINER	
LAW OFFICES OF MARK C. PICKERING P.O. BOX 300 PETALUMA, CA 94953			NGUYEN, HA T	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 02/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/727,451	Applicant(s) HOPPER ET AL.	
	Examiner Ha T. Nguyen	Art Unit 2812	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 December 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 14-20 and 30-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14-20 and 30-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Notice to applicant***

1. Applicants' Amendment and Response to the Office Action mailed 9-29-4 and Request for a Continued Examination have been entered and made of record. Following is an Office Action responding to the request.

### ***Claim Objections***

2. Claims 14-20 and 30-38 are objected to because of the following informalities: In claim 14, line 12, before “;”, insertion of --of the layer of insulation material -- is suggested for clarity. Appropriate correction is required.

Claims 15-20 and 30-38 variously depend from claim 14, they are objected to for the same reason.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

### ***Claim Rejections - 35 USC § 103***

3. Claims 14-16, 18-20, and 30-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al. (USPN, hereinafter “Lu”) in view of Adams et al. (USPN 6566242, hereinafter “Adams”) and Inohara et al. (USPN 5976972, hereinafter “Inohara”).

[Re claim 14] Referring to Figs. 1-9 and related text, Lu discloses a method of forming a semiconductor device, the method comprising the steps of: forming a layer of insulation material 12 over a semiconductor substrate 22, the layer of insulation material having a top surface, the semiconductor substrate having a top surface; etching the layer of insulation material to form a trench 24 in the layer of insulation material, the trench having a depth measured normal to the top surface of the substrate and a width, directions associated with the depth and the width being orthogonal to each other, the trench having a bottom surface vertically spaced a first distance apart from the top surface of the insulation material; and etching the trench to lower the bottom surface of the trench to form a lowered bottom surface that is vertically spaced a second distance apart from the top surface of the layer of insulation material, the second distance being greater than the first distance (see Fig. 8). But it fails to disclose expressly etching the insulation material

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to form a plurality of trenches in the layer of insulation material, the top surface of the layer of insulation material having a trench region that lies between adjacent trenches and etching the layer of insulation and the plurality of trenches to lower the top surface of the layer of insulation material in the trench region to form a trench surface that lies below and parallel to the top surface and the trench having a length that is many times greater than the width and the direction associated with the length is orthogonal to the directions associated with the depth and the width. However, the missing limitation are well known in the art because Adams discloses most of these features (See Figs. 5-9 and related text ) and Inohara teach trenches having length many time greater than the width (see Figs. 11, and 20-21). A person of ordinary skill is motivated to modify Lu with Adams and Inohara to obtain interconnection with larger contact area to more than one devices.

[Re claims 15, 16, and 18-20] Lu also discloses wherein the step of etching the layer of insulation material and the trench includes the steps of: forming a layer of masking material 26 on the layer of insulation material; patterning the layer of masking material to expose a portion of the top surface of the layer of insulation material and the plurality of trenches; and anisotropically etching the layer of insulation material and the trench (see Fig. 7); forming a layer of conductive material on the layer of insulation material to fill up the trench (see col. 5, lines 16-18); and planarizing the layer of conductive material to form a conductive region, the conductive region having a top surface that is substantially planar with the top surface of the layer of insulation material, the conductive region in the trench forming a bottom finger surface that lies parallel to the top surface of the layer of insulation material (see Fig. 9); wherein a top surface of a single contact 22 is directly connected to the bottom finger surface; wherein the layer of conductive material includes a barrier layer formed on the layer of insulation material; a layer of seed material formed on the layer of barrier material; and a layer of copper formed on the layer of seed material (see col. 9, line 41-col. 10, line 30).

[Re claim 30] The combined teaching of Lu , Adams and Inohara also discloses wherein the plurality of trenches lies substantially parallel to each other ; [Re claims 31 and 33] wherein the lowered bottom surface exposes a nonconductive material (see Inohara, Figs. 20-21, #13a, 13b).

[Re claims 32, 34, and 39] The combined teaching of Lu , Adams and Inohara discloses substantially the limitations of claims 32, 34, and 39, as shown above. It also discloses wherein the lowered bottom surface exposes a conductive material 21 , an exposed area of the nonconductive material 13b being substantially greater than an exposed area of the conductive material; [Re claim 36 ] wherein the conductive material is a top surface of a contact 21 (see Inohara, Figs. 20-21).

[Re claim 35] The combined teaching of Lu , Adams and Inohara does not expressly disclose wherein the conductive material is a top surface of a via. However, it would have been obvious for an ordinary artisan to use a via when an additional underlying interconnect layer is needed.

[Re claims 37 and 38] The combined teaching of Lu , Adams and Inohara also discloses forming a conductive layer on the layer of insulation material, the conductive layer filling up the trenches (see Lu, col. 5, lines 16-18); and planarizing the conductive layer to form a conductive region, the conductive region having a top surface that is substantially planar with the top surface of the layer of insulation material, the conductive region in the trenches forming a plurality of bottom fingers with bottom surfaces that lie parallel to the top surface of the layer of insulation material (see Lu, Fig. 9); wherein a top surface of a single contact 22 is directly connected to the bottom finger surface; wherein the first distance is a depth measurement.

[Re claims 40-42 ] The arguments stated in the rejections of claims 30, 35 and 36 also apply.

Therefore, it would have been obvious to combine Lu with Adams and Inohara to obtain the invention as specified in claims 14-16, 18-20, and 30-42.

4. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lu in view of Adams and Inohara, as applied to above, and further in view of Yu et al. (USPN 5952704).

The combined teaching of Lu, Adams and Inohara discloses substantially the limitations of claim 17, as shown above.

But it does not disclose expressly wherein the conductive region is formed to have a number of loops; wherein the loops lie substantially in a same plane; the loops being electrically connected together.

However, the missing limitations are well known in the art because Yu discloses these features (See Figs. 1-5).

A person of ordinary skill is motivated to modify Lu, Adams and Inohara with Yu to obtain an inductor with reduce parasitic capacitance (see Yu, abstract).

### ***Response to Amendment***

5. In view of applicants' cancellation of the claims, the objection to or rejections of claims 22-29, as stated in the Office Action mailed 9-29-4, are rendered moot.

In view of applicants' amendment to the claims, the rejections of claims 14-20 under 35 U.S.C. 102 or 103, as stated in the Office Action mailed 9-29-4, have been withdrawn.

In view of the new ground of rejection, applicants' arguments are rendered moot.

### ***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire **THREE MONTHS** from the date of this action. In the event a first response is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than **SIX MONTHS** from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt, can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Ha Nguyen

Primary Examiner

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